

## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>6</sup> : <b>A61B 17/56</b>	<b>A1</b>	(11) International Publication Number: <b>WO 99/09900</b> (43) International Publication Date: 4 March 1999 (04.03.99)
--	-----------	---

(21) International Application Number: PCT/US98/17541  
(22) International Filing Date: 25 August 1998 (25.08.98)

(30) Priority Data:  
08/918,790 25 August 1997 (25.08.97) US

(71) Applicant: DEPUY ORTHOPAEDICS, INC. [US/US]; 700 Orthopaedic Drive, Warsaw, IN 46581 (US).

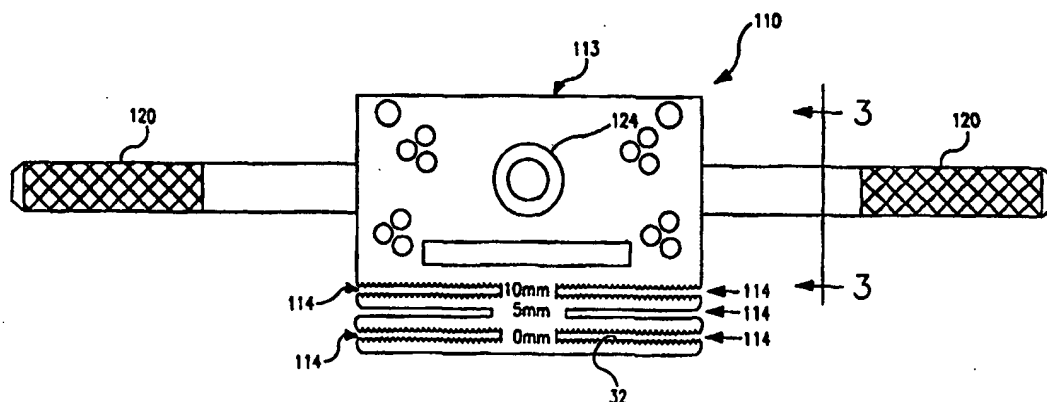
(72) Inventor: MARTIN, Troy, D.; 8339 East 350 North, Pierceton, IN 46562 (US).

(74) Agent: COFFEY, William, R.; Barnes & Thornburg, 11 South Meridian Street, Indianapolis, IN 46204 (US).

(81) Designated States: JP, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published  
With international search report.

(54) Title: LOW FRICTION SAW SLOT



## (57) Abstract

An instrument (10) is provided in accordance with the present invention for guiding the resection of a bone (12). Instrument (10) includes a saw guide (13) formed to include a slot (14). The slot (14) is defined by an upper guide surface (26) and lower guide surface (28). Guide surfaces (26, 28) are intermittent surfaces to provide a low-friction saw guide surface. Guide surfaces (26, 28) form waves (32), the upper surfaces (34) of which lie in a common plane.

**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakistan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

## LOW FRICTION SAW SLOT

### Background of the Invention

5 The present invention relates to surgical instruments, and particularly to guides for saw blades used in bone resection.

During various surgical procedures such as implantation of prosthetic knee joints, ankle joints, shoulder joints, finger joints, etc., it is often necessary to make cuts or resections of bone in order for the prosthetic device to be implanted. Typically, these resection procedures involve connecting cutting blocks to the bone  
10 using intermedullary rods, screws or the like, and resecting portions of the bone by cutting along a guide path defined by guides that are formed in the cutting blocks. The guide paths formed in the cutting block guide the surgeon's saw blade in a predetermined direction, usually along a straight line, with respect to the mounted cutting block. Once the bone has been properly resected in the appropriate locations,  
15 the prosthetic device can then be secured to the bone and the implantation procedure can be completed.

The prior art includes different types of guides for producing a cut or resection in an anatomical structure relative to some reference plane or line. See, for example, U.S. Patent No. 4,738,253 and U.S. Des. Patent Nos. 272,853 and 272,854.  
20 However, the guides that are currently known have a number of problems. For example, some of the current cutting guides include a single guide surface (made of stainless steel or the like) upon which a saw blade rests as the saw blade is reciprocated or oscillated along the cutting path. As the resection is being made, the saw blade is pressed against the single-sided guide surface and the saw blade has a tendency to bend  
25 or bow as the resection is being made. To solve this problem, more recent guides include slots for guiding the saw blade. The saw blade is thus bounded on both sides and can reciprocate within the slot so that the amount of saw blade bowing is minimized.

However, both single-sided guides and slot guides currently in use  
30 include a smooth guide surface (or surfaces), usually made of stainless steel, upon which the saw blade travels as it reciprocates or oscillates along the desired cut path. As a result, the saw blade has a tendency to bind or gall against the smooth surface

because there is a lot of friction. This in turn causes the bone resections to be less accurate and more difficult because the saw blade is over-stressed. Thus, surgeons who perform bone resections would appreciate a cutting block that included a low-friction guide surface because the bone could be resected more easily and more accurately if the saw blade did not bind, gall, or bow.

### Summary of the Invention

According to the present invention, an instrument for guiding the resection of a bone is provided. The instrument includes a saw guide formed to include a slot for receiving and guiding a saw blade. The slot has an irregular saw blade engaging surface for contacting the saw blade and reducing friction. Preferably, the irregular surface is defined by a plurality of waves, the upper surfaces of which lie in a common plane. However, the irregular surface may also be defined by bumps, spikes, or any other geometric configuration so long as the irregular saw blade engaging surface reduces friction.

In a second embodiment, a saw guide for use with a surgical instrument to resect a bone is provided. The saw guide includes a body and a plurality of waves extending outwardly from the body. The plurality of waves defines an irregular saw blade engaging surface for guiding a saw blade and reducing friction. Preferably, in the second embodiment, the body is a block having a slot formed therein with a second and opposing blade engaging surface parallel to and spaced apart from the first engaging surface, the second surface being defined by a plurality of bumps.

In a third embodiment of the present invention, a process for resecting a bone is provided. The process involves drilling a hole in the bone, inserting a guide rod into the hole, attaching a cutting block to the bone using the rod, and manipulating a saw blade along the cutting block to resect the bone. The cutting block includes an irregular guide surface so that as the saw blade is manipulated along the irregular guide surface, friction is reduced.

Additional features and advantages of the invention will become apparent to those skilled in the art upon consideration of the following detailed description of preferred embodiments exemplifying the best modes of carrying out the invention as presently perceived.

### Brief Description of the Drawings

The detailed description particularly refers to the following figures in which:

Fig. 1 is a perspective view of an instrument in accordance with the present invention for resecting a bone showing the instrument as it would appear after being mounted to the bone;

Fig. 2 is a front view of an alternative embodiment of an instrument in accordance with the present invention, showing a cutting block including a plurality of saw guides, each having an irregular guide surfaces to reduce friction;

Fig. 3 is a view taken along lines 3-3 of Fig. 2 showing the saw guides extending into the cutting block;

Fig. 4 is a enlarged perspective view of the guide surface of the cutting block of Fig. 2 showing the guide surface being defined by waves;

Fig. 5 is a front view of an alternative embodiment of cutting block of Fig. 4 having a plurality of saw guides with irregular guide surfaces;

Fig. 6 is a section view of the cutting block taken along lines 6-6 of Fig. 5, showing the saw guides having an angled orientation;

Fig. 7 is an enlarged view of saw guides in the cutting block of Fig. 2, showing the irregular guide surface of the saw guides having waves with flattened top portions;

Fig. 8 is a view similar to Fig. 4 of an alternative embodiment of the present invention showing a cutting block having an irregular guide surface being defined by spikes formed in the cutting block; and

Fig. 9 is a view similar to Fig. 4 of an alternative embodiment of the present invention showing a cutting block having an irregular guide surface being defined by bumps formed on the cutting block.

### Detailed Description of the Drawings

An instrument 10 for resecting a bone 12 in accordance with the present invention is shown in Fig. 1. Instrument 10 includes a saw guide or cutting block 13 formed to include a slot 14 for receiving and guiding a saw blade (not shown) along a path to resect or cut bone 12. Instrument 10 further includes a mounting

block 15 having a pair of handles 20 for maneuvering instrument 10 and a guide rod 16 for connecting mounting block 15 to bone 12. Once a hole (not shown) is drilled into bone 12 and mounting block 15 is connected to bone 12 using guide rod 16, cutting block 13 can be connected to mounting block 15. Then, a resection can be made by reciprocating or oscillating a saw blade (not shown) within slot 14 along the path defined by slot 14.

Instrument 10 also preferably includes a stylus 18 for aligning the depth of the bone cut. Stylus 18 is appended to mounting block 15 and includes a tip 19 that is positioned to touch the lowest part of bone 12 so that a proper resection can be made. With instrument 10 connected to bone 12 and tip 19 of stylus 18 positioned against the lowest part of bone 12, a saw blade (not shown) can be inserted into slot 14 and reciprocated or oscillated along the path defined by slot 14 until bone 12 is completely resected.

As shown in Figs. 1 and 4, cutting block 13 is formed to include waves 32. Further, waves 32 have peaks 34. As shown in Fig. 1, slot 14 is defined by an upper guide surface 26 and lower guide surface 28. Guide surfaces 26, 28 are irregular (or intermittent) surfaces in order to provide a low-friction saw guide surface. Upper and lower saw blade guiding surfaces 26, 28 define a path in the slot 14 in which a saw blade can be guided. With the saw blade positioned in slot 14, saw blade guiding surfaces 26, 28 guide the saw blade as the saw blade reciprocates or oscillates along the path so that a proper resection can be made. While guide surfaces 26, 28 are illustrated and described it is understood that only one guide surface is suitable for use in the present invention as shown in Figs. 4, 8, and 9.

Waves 32 may be formed in cutting block 13 using wire cutting techniques that are known in the art. Using the wire cutting techniques, waves 32 are formed into cutting block 13 such that waves 32 are rounded as shown in Fig. 4. In the preferred embodiment, waves 32 are semi-circular and have peaks 34 that define the irregular saw blade engaging surfaces 26, 28. As shown in Figs. 8 and 9, cutting blocks 413, 513 may also be formed to include spikes 42 or bumps 44 that define the irregular saw blade guiding surfaces 26, 28. Whether the saw blade guiding surface 26 or surfaces 26, 28 are defined by waves 32, spikes 42, or bumps 44, the resultant irregular surfaces 26, 28 reduce friction, galling, and bowing of a the saw blade when a

bone resection is performed. It is believed that the surface area of the saw blade guiding surface which engages the saw blade is reduced. Thus, it is within the scope of this invention that a variety of other irregularly shaped surfaces or methods could be used to reduce the saw blade engaging surface area thereby reducing the friction, galling, or bowing of the saw blade during bone resection procedures.

An instrument 110 is an alternative embodiment of the present invention and is shown in Fig. 2. Instrument 110 includes a unitary mounting/cutting block 113. Mounting/cutting block 113 has handles 120 for maneuvering the mounting/cutting block 113 relative to bone 12. Mounting/cutting block 113 is also formed to include a hole 124 for receiving a guide rod 16 to mount the mounting/cutting block 113 to bone 12. Mounting/cutting block 113 is further formed to include a plurality of slots 114. Slots 114 are sized to accommodate a variety of saw blade sizes and shapes.

As shown in Fig. 2, each of the saw guide slots 114 is defined by a pair of upper and lower saw blade engaging surfaces 126, 128. The saw blade engaging surfaces 126, 128 are generally parallel to one another. It is understood, however, that only a single saw blade engaging surface 126 could be used; or if multiple saw blade engaging surfaces are used, the surfaces could be configured in a non-parallel relationship that is not substantially straight. Thus, surgeons could create any one of a wide variety of bone resections.

An instrument 210 of an alternative embodiment of the present invention includes a cutting block 56, as shown in Figs. 5 and 6. Cutting block 56 is similar to the cutting block 13 and mounting/cutting block 113 except that cutting block 56 includes a closed-loop saw guide slot 60 and a pair of open-ended saw guide slots 62, 64. Guide slots 62, 64 are defined by saw guide surfaces 226, 228. Cutting block 56 includes a first face 58, an opposite second face 59, and a side wall 61 extending therebetween. Cutting block 56 further including a top platform 63. Open-ended saw guide slots 62, 64 extend between first and second faces 62, 64 at an angle of about  $11^\circ$  with respect to the top platform 63. Both the open-ended saw guide slots 62 and 64 and the closed-loop saw guide slot 60 can be formed to include waves 32 (Fig. 4), spikes 42 (Fig. 8), and/or bumps 44 (Fig. 9) and may be formed at any angle relative to the cutting block.

Waves 32 of Fig. 2 are shown in greater detail in Fig. 7. Peaks 34 of waves 32 include a flattened top portion 70 so that the wear on a saw blade engaging surface 36 will be reduced. Preferably, the flattened top portion 70 is approximately 0.006 inch (0.015 cm). Spikes 42 or bumps 44 could also be formed to include

5 flattened top portions to reduce wear.

Although cutting block 13 and cutting block 56 are used in connection with resections performed on ends of femurs in knee replacement surgery, the irregularly shaped saw blade engaging surfaces 36 formed in cutting blocks 13, 113, 56, 413, and 513 may be used for any bone resection.

10 Although the present invention has been described in detail with reference to certain preferred embodiments, variations and modifications exist within the spirit and scope of the invention as described and defined in the following claims.



CLAIMS:

1. An instrument for guiding resection of a bone comprising:  
a saw guide providing a slot for receiving and guiding a saw blade;  
5 said slot having an irregular saw blade engaging surface for contacting  
the saw blade and reducing friction.
2. The instrument of claim 1, wherein the irregular surface is  
defined by a plurality of waves, the upper surfaces of which lie in a common guide  
plane.
- 10 3. The instrument of claim 1, wherein the irregular surface is  
defined by a plurality of bumps, the upper surfaces of which are flattened to provide a  
plurality of individual guide surfaces lying in a common plane.
4. The instrument of claim 1, wherein the irregular surface includes  
15 peaks and valleys such that the peaks of the bumps define the saw blade engaging  
surface.
5. The instrument of claim 1, wherein the irregular surface is  
defined by a plurality of spikes.
6. The instrument of claim 5, wherein the spikes include flattened  
top portions that define the saw blade engaging surface.
- 20 7. For use with a saw blade to resect a bone, an instrument for  
attachment to the bone and a saw block connected to the instrument for establishing  
the location and direction of the resection, said block having an intermittent surface for  
engaging and guiding the blade and reducing friction.
8. The instrument of claim 7, wherein the intermittent surface is  
25 defined by a plurality of waves.
9. The instrument of claim 7, wherein the intermittent surface  
includes peaks and valleys such that the peaks of the bumps define the saw blade  
engaging surface.
10. The instrument of claim 9, wherein the waves have a flattened  
30 top surface to guide the saw blade along the saw blade engaging surface.

11. The instrument of claim 7, wherein the intermittent surface is defined by a plurality of spikes, having flattened top portions that define the saw blade engaging surface.

12. The instrument of claim 7, wherein the intermittent surface is defined by a plurality of bumps.

13. The instrument of claim 7, wherein the intermittent surface defines a plane that is substantially flat.

14. A saw guide for use with a surgical instrument to resect a bone, the saw guide comprising:  
a body; and  
a plurality of waves extending outwardly from the body and defining an irregular saw blade engaging surface for guiding a saw blade and reducing friction between the saw blade and the engaging surface.

15. The saw guide of claim 14, wherein the body is a block having a slot formed therein with a second and opposing blade engaging surface parallel to and spaced apart from the first said engaging surface, said second surface defined by a plurality of bumps.

16. The saw guide of claim 15, wherein the bumps include peaks and valleys such that the peaks of the bumps define the saw blade engaging surface.

17. The saw guide of claim 15, wherein the bumps have a flattened top surface to guide the saw blade along the saw blade engaging surface.

18. A process for resecting a bone comprising:  
drilling a hole in the bone,  
inserting a guide rod into the hole,  
attaching a cutting block to the bone using the rod, the cutting block having an irregular guide surface, and  
manipulating a saw blade along the irregular guide surface to resect the bone along a plane defined by the irregular guide surface.

19. The process of claim 18, wherein the irregular guide surface is a plurality of bumps.

20. The process of claim 19, wherein the bumps have a flattened top surface to guide the saw blade along the saw blade engaging surface.

21. The process of claim 18, wherein the irregular guide surface is a plurality of spikes.

22. The process of claim 21, wherein the spikes have a flattened top surface to guide the saw blade along the saw blade engaging surface.

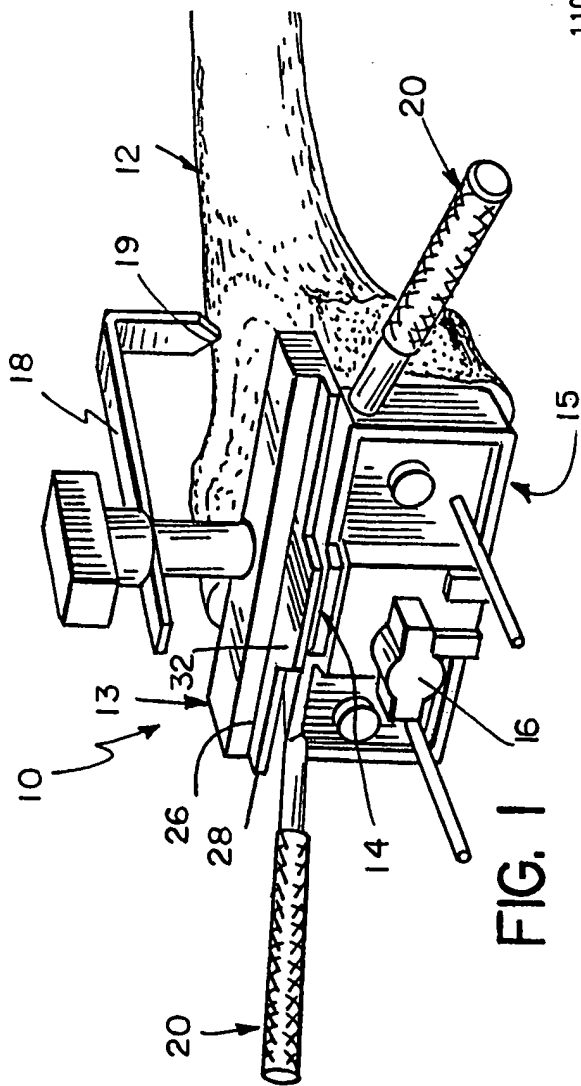


FIG. 1

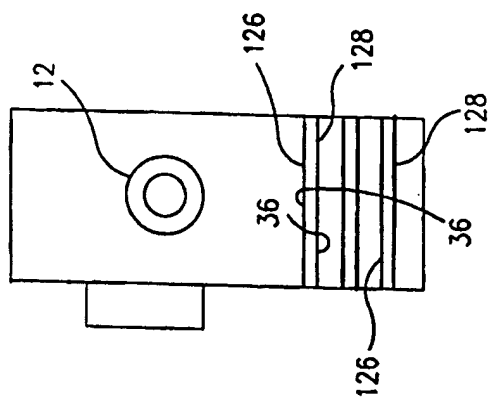


FIG. 3

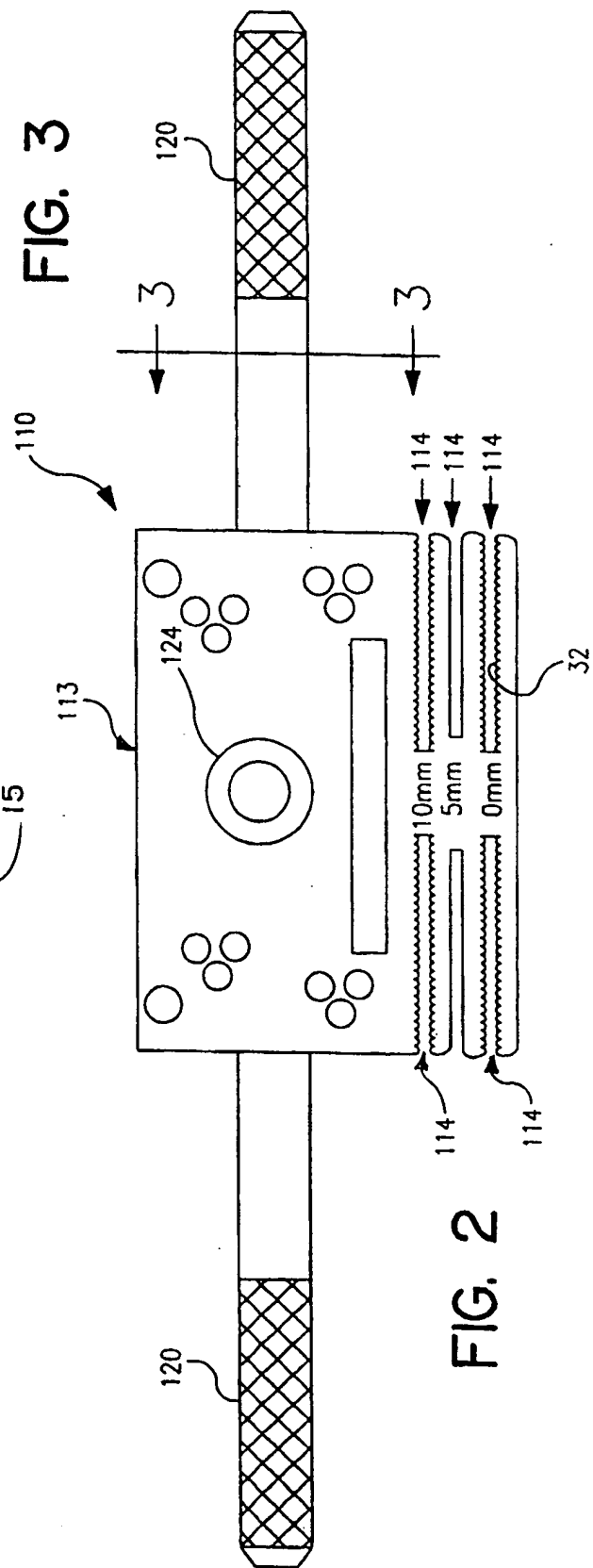


FIG. 2

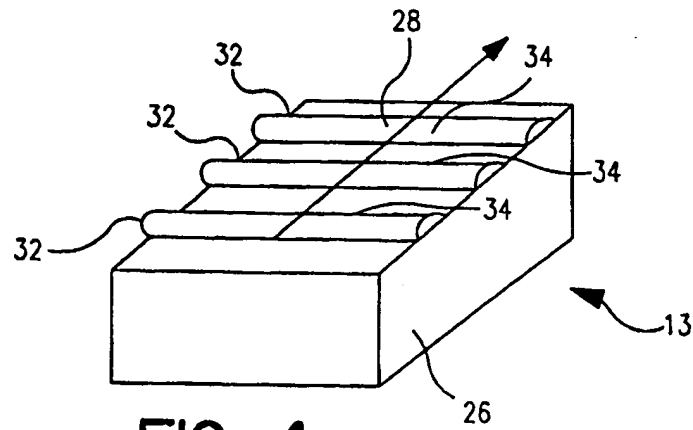


FIG. 4

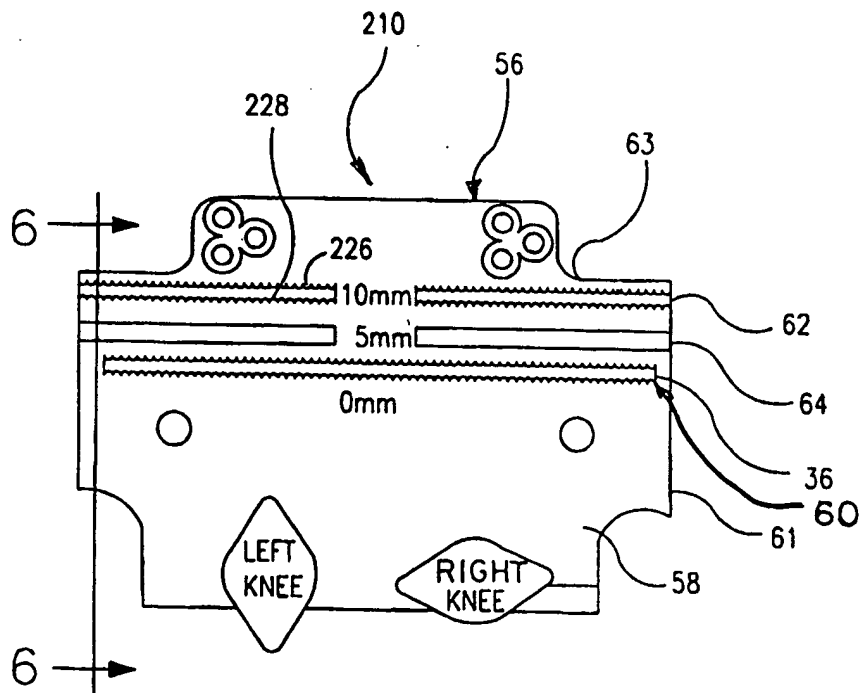


FIG. 5

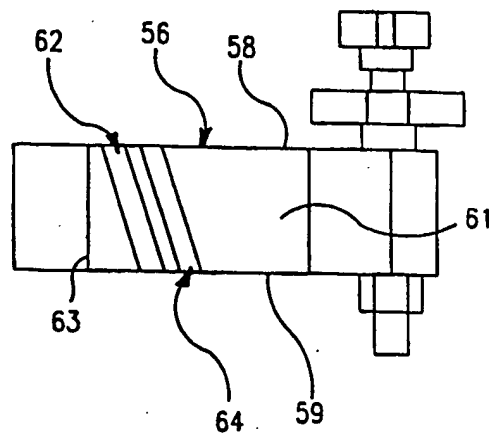


FIG. 6

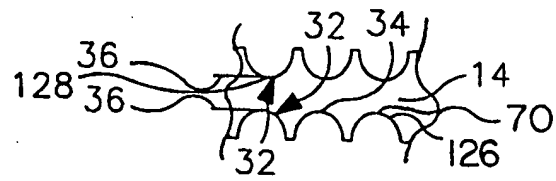


FIG. 7

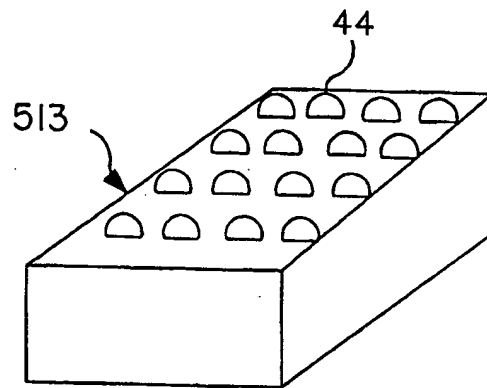


FIG. 9

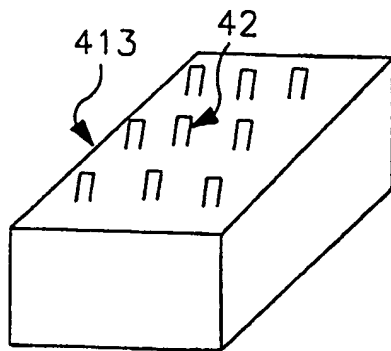


FIG. 8

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US98/17541

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : A61B 17/56

US CL : 606/88

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 606/79, 82, 86-89

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
none

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X, P	US 5,683,397 A (VENDRELY et al.) 04 November 1997 (04.11.97), Fig. 3a.	1, 7, 18
A	US 5,490,854 A (FISHER et al.) 13 February 1996 (13.02.96), entire reference.	1, 7, 18



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
*A* document defining the general state of the art which is not considered to be of particular relevance	*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
*E* earlier document published on or after the international filing date	*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
*L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*Z* document member of the same patent family
*O* document referring to an oral disclosure, use, exhibition or other means	
*P* document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

21 SEPTEMBER 1998

Date of mailing of the international search report

21 OCT 1998

Name and mailing address of the ISA/US  
Commissioner of Patents and Trademarks  
Box PCT  
Washington, D.C. 20231

Facsimile No. (703) 205-2320

Authorized officer

GUY V. TUCKER

Telephone No. (703) 205-2321